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ABSTRACT

A group of psychologists met to consider and assess the potential contribution of psychology to educational research and development and, more specifically, to programs directed toward the problems of equality, quality, and efficiency in education. It is reported that the various fields of differential psychology, learning theory, developmental psychology, counseling and clinical psychology, and social and community psychology all need to be involved in any scientific attack on the three major problems in education mentioned above. Each of the fields are briefly reviewed in light of suggestions on how each field can relevantly contribute toward solving educational problems. Psychologists have much to offer NIE in the area of program evaluation and assessment, and experimental revision. The report also deals with the need for human resources and training of scientific personnel, teache , and psychologists in a type of research that combines discipline and tasks, i.e., in which theory can be applied. Emphasizing that effective educational research needs to be interdisciplinary in approach, suggestions are made for a series of meetings devoted to interdisciplinary aspects. Arguments, pro-and-con, for NIE support of the training of behavioral scientists and after thoughts of several participants are summarized. Related documents are ED 047 167, SO 005 738 and SO 005 740. (SJM)

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THE PLACE OF PSYCHOLOGY

IN A

NATIONAL INSTITUTE OF EDUCATION

Report of a Planning Conference
for the NIE Planning Unit

July 22-23, 1971

The Institute for Advanced Study
Princeton, New Jersey

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NATIONAL INSTITUTE OF EDUCATION
Planning Unit

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THE PLACE OF PSYCHOLOGY IN A NATIONAL INSTITUTE OF EDUCATION

Many of the educational problems facing the country today involve psychological factors. Learning itself is a psychological process, and its progress is affected by the capacities, prior achievements, and motivation of those expected to profit from it. Any efforts by the National Institute of Education to improve or facilitate the educational experience in America is certain to encounter these psychological factors. It is clear, therefore, that the science of psychology will necessarily play an important role in the work of NIE.

It is not equally clear, however, that the science of psychology, as we know it in the United States in 1971, is ready to meet this challenge. Lacking federal funds and coordination, the psychological community in this country has not pursued the educational implications of psychology as vigorously as it might have; certainly, little has been done by psychologists along interdisciplinary lines. But the situation is far from hopeless. Even without such special attention, much good work has been done, and good ideas for further work are plentiful. There is much of solid value to build on, and psychologists as a group have quite a good history of being able to use their science to deal with new problems when adequately motivated and supported. But the fact remains that we do not know as much about educational psychology as we need to know or could know. Before psychology can make its proper contribution to the mission of NIE, NIE must in turn contribute to strengthening psychology as one of the educational sciences.

That, however, will take time. Meanwhile, the nation faces critical educational problems that will not wait patiently for scientific progress. One must ask, therefore, what psychology is prepared to contribute to the amelioration of those problems right now and in the immediate future. This question was the subject of discussion at a conference sponsored by the NIE Planning Unit, July 22-23, 1971, at The Institute for Advanced Study in Princeton, New Jersey. Participants at the conference included psychologists Michael Cole, David Elkind, Robert Glaser, Charles W. Thomas, Edward F. Zigler, and George A. Miller (chairman), along with Harry Silberman, Joseph I. Lipson, and Beverly Kooi from the NIE Planning Unit, John M. Mays from the Office of Science and Technology, and Alice Healy (recorder).

THREE PROBLEM AREAS

The scope of the discussion was defined by Roger E. Levien's report, *National Institute of Education: Preliminary Plan for the Proposed Institute* (R-657-HEW, February 1971). According to this preliminary plan, NIE should be concerned with improving the education of the disadvantaged, improving the quality of education generally, and making more effective use of limited educational resources. These three topics are sufficiently broad to include all of the immediate practical problems of American education. Moreover, the fact that many of these problems have important psychological aspects was clearly recognized in the Levien report.

1. Improving education of the disadvantaged. Do certain home conditions hamper early psychological development? What are the effects of insufficient verbal and intellectual stimulation in early years? Are there language difficulties arising from nonstandard dialects? Are school curricula inappropriate to the disadvantaged child's experience and interests? Do narrow measures of capability and development affect student morale and teacher expectations? Is the motivation of the student to achieve academic success inadequate? Are teachers sufficiently informed of special needs of the disadvantaged? Are more intensive instructional programs needed? It is suggested that basic studies, curriculum development and research, studies of early childhood education, a program of experimental schools, new measures of educational achievement, and feedback of results to teachers are among the activities that would help to redress educational deficiencies of disadvantaged students.

2. Improving the quality of education. Is the standard educational fare viewed by students as irrelevant and uninteresting? Is a wide enough diversity of educational choices available to parents and students? Does the educational system fail to serve the career needs of many students? Can more effective methods of instruction be developed? It is suggested that a program of experimental schools, curriculum development, support for experimentation with new forms of education, and a search for better ways of linking individual and community needs, educational objectives, and school services are among the activities that would improve the quality of education.

3. Improving the effectiveness of resource use. This seems to be the least psychological of the three major problems, but even here psychologists should be able to contribute to better decision-making by educational administrators and school boards; to the development of better evaluative techniques and criteria; and to the design of a school day that makes more efficient use of teachers' and students' time and effort.

Of course, NIE will also support basic psychological research that is educationally relevant, but the major initial effort is to be oriented toward these more immediate and pressing problems of our educational systems. It would be unreasonable to expect that any of these problems could be "solved" with educational R&D in the way NASA, for instance, achieved its goal of sending a man to the moon. For example, the problem of educational equality can never be finally solved in a society where poverty and racial prejudice still exist, no matter how excellent the schools (See Afterthoughts below). Yet there is much that can be done within the charter of NIE to ameliorate these problems.

However, because of the political realities that NIE will face, it will probably be necessary to devise subproblems or subgoals where substantial progress can be quickly realized and demonstrated to Congress. If one accepts this requirement, then a difficulty with most existing educational R&D programs, which include the experimental schools program, the programs of the regional laboratories, and the programs of the R&D Centers, is that they have not defined clearly specified outcomes or set firm terminal dates for achieving them. These programs would have to be assessed along those lines when NIE takes responsibility for them so that their activities could be successfully monitored and integrated into a coherent program. Successful supervision by NIE would also necessitate devising new and improved methods of program assessment and evaluation—a difficult task in itself. The imposition of such criteria would require a reinterpretation of the nature and role of these programs; in particular, many of the R&D Centers have unique properties that capitalize on scientific and university resources in the interests of long-term developments. Care should be taken that these intellectual assets are not lost under the pressure to demonstrate rapid and substantial progress.

Given the problem in these terms, the conference attempted to assess what knowledge psychology might presently contribute to programs directed toward equality, quality, and efficiency in education.

RELEVANT FIELDS OF PSYCHOLOGY

Although all fields of psychology might contribute potentially to our scientific base for improving education, certain fields are more immediately relevant than others. In particular, differential psychology (the psychology of individual differences), learning theory, developmental psychology, counseling and clinical psychology, and social and community psychology are fields that must be involved in any scientific attack on the problems of educational equality, quality and efficiency. These fields are briefly reviewed here, although no serious attempt is made to assign program priorities among them.

Differential Psychology. Individual students vary considerably in their aptitudes and interests. Teachers should be aware of these differences among their students, and to that end psychologists have devised and standardized a variety of tests of ability, achievement, and personality—tests in the classroom. A teacher's task is not to eliminate such differences, but to exploit them—to help each student realize his potential, whatever it may be.

Test procedures, and especially the uses to which test results are put, have never been above criticism, but in recent years the popular attack on this kind of psychotechnology has grown increasingly intense. Today the charge is frequently heard that psychological tests are used to exclude disadvantaged individuals from access to educational opportunities. If these allegations were correct, a simple way to promote greater equality of educational opportunity would be to ban all testing programs or to forego any administrative use of the results of such testing programs. Alternatively, the nature of these tests might be modified in order to sample a wide range of abilities and achievements, or the results might be reported in greater detail to reflect more adequately the complex differences among individuals.

Knowing the different aptitudes and personality characteristics of each student is of little help to a teacher who must deal with the class as a whole at, say, the level of the average student, and so cannot give differential instruction to each student depending on his

particular aptitudes and present state of knowledge. Although in the past the large size of the average class has prohibited individualized instruction, today computer-assisted instruction and cross-age interaction (which enables older students to tutor younger students) make individualized instruction a more realizable goal.

Nevertheless, differential teaching on the basis of differential aptitudes is still a problem. Psychologists have conducted studies to assess the extent to which instructional treatments must be matched to aptitudes in order to obtain optimal learning. As Glaser and Resnick remark in their recent review, "Instructional Psychology" (*Annual Review of Psychology*, 1972, Vol. 23), most of these "aptitude treatment interaction" studies are negative. In very few cases did individuals with different aptitudes respond differentially to the different treatments. Glaser and Resnick attribute this result to the fact that the aptitudes and abilities tested were defined as such because tests with predictive power were available, rather than because the tests diagnosed specific behavioral processes.

Aptitudes measured by psychological means are seldom either educationally diagnostic or prescriptive; they do not tell a teacher what to do. Indeed, every effort is made to make the test results predictive and reliable, i.e., resistant to change. Obviously, a different rationale for testing is needed in this situation. Perhaps we should learn to test component processes rather than stable aptitudes and dispositions. Learning theorists and those working in such fields as computer simulation—those who have been devising "process models"—have not interacted with testing experts in devising educationally appropriate measures of individual differences in cognitive processes. Such interaction should be fostered by NIE, since this would seem to be an area where relatively limited funds could demonstrate important potentialities.

Tests measuring individual differences in cognitive processes have their own weaknesses, however. It can be argued that noncognitive, personality variables (such as need achievement, distractability, motivation, social competence, level of aspiration) must also be measured in order to obtain a valid picture of a student's aptitudes. For example, the Sioux Indians' seemingly poor performance on certain tests was due in part to their reluctance to assert themselves. Similarly, the relatively poor performance of nonurban children may result from the fact that they are not accustomed to interacting with strangers. Or, again, an answer of "I don't know" by a minority youth may not reflect cognitive or motivational variables, but merely a basic mistrust of adults.

Inappropriate use of measurements of individual differences in the past has led to a group of problems that might be solved if measurement techniques were improved. For example, perfectly competent Black children have been put into classes for the mentally retarded because the tests used to assess their intelligence have not considered personality factors or have not been culturally fair. Tests should be devised and standardized for the healthy Black student in Harlem, for example. For a full understanding of the Black child, concepts such as mastery and coping should replace such negative "deficit" concepts as disadvantaged and neurotic.

Minority students are not the only ones who suffer from the traditional system. Although tracking (grouping of students by ability) may help solve the instructional problem caused by large individual differences, such a procedure can be disastrous for a slow learner. A student assigned to the slow track is quick enough to learn that he is a slow learner; thus he often picks up a negative selfconcept that may lead to a "self-fulfilling prophecy." In contrast, the success of Black Muslim schools may be due, at least in part, to their use of racial pride as a way to confirm the student's identity.

Teachers as well as tests must change before the present system can improve. Teachers should learn to understand and tolerate individual differences. They must view aptitude measures as descriptive rather than normative. Furthermore, they should not be bound by test scores to the point of ignoring their own common sense. For instance, when a child fails to discriminate a triangle from a circle on an IQ test, but has no problem getting home from school every day, a teacher should at least suspect that the test is not successfully measuring the child's abilities. Teachers must understand that such common-sense observations are legitimate.

Learning Theory. Learning theory, the field of psychology dealing with a process that is central to education, has been of strangely little help to the educator. As W. K. Estes pointed out in his recent book, *Learning Theory and Mental Development* learning theory has little to offer to the understanding of either

mental retardation or normal cognitive development. In its present state this theory is largely irrelevant to the practical problems of education. For instance, the study of "learning sets" or "learning to learn," although seemingly very relevant to education, has not been of much help when applied in the schools.

However, the psychology of learning is currently changing in a direction that should benefit its relation to education, i.e., it is moving from performance description to process description; it is becoming more analytic and more cognitive. For example, considerable attention is currently being given to retrieval cues in recall, and to the importance of considering conditions of future utilization before deciding how information should be organized for storage in memory. Moreover, individual difference variables and the effects of different styles of learning are now being incorporated into contemporary learning theory.

One basic concept from learning theory that has already found its way into educational practice is the notion that rewards or "positive reinforcements" are an important component of the learning process. People learn—they change their behavior—in light of what they know (or think they know) about its consequences. The most thorough-going application of this principle is to be found in programmed instruction. In programmed instruction, either by computers or through more conventional channels, the student gets immediate reinforcement (knowledge of results, or "feedback") as he learns.

Another application of reinforcement theory to education is "applied behavior analysis" or "behavior modification." Social reinforcement (praise or attention), token economies (points or counters later exchanged for more tangible rewards) and contracts (agreements between teacher and students) are now being systematically employed in the classroom. Psychologists are divided both as to the effectiveness and the propriety of behavior modification techniques in education; evaluation and assessment of the possibilities and limitations, however, would seem to be an important task for NIE.

In considering the relevance of reinforcement theory to education, several recommendations can be made. The need to reinforce the intention behind behavior, rather than the behavior per se, is of foremost importance. Creative behavior, which is often ignored by a teacher, should be positively reinforced. Slow learners should be rewarded as well as rapid learners. A student's family should be told when he performs well in school, so that reinforcement is extended to the family as well as the student. The student should be helped to develop a capacity for self-reinforcement, so that study habits will be maintained when the student is working alone.

A related area of learning theory applicable to the classroom is "modeling" or "observational learning." Observational learning consists simply of imitating the behavior of a teacher or model. Reinforcement occurs in observational learning in the form of "vicarious reinforcement" applied to the model rather than the observer; the observer discovers vicariously the consequences of particular acts. Work on modeling points up another pervasive problem for students of minority groups: new models, other than the white, middle-class model, must be developed along ethnic lines for these groups.

A form of reinforcement that should be particularly appropriate in an educational context is "dissonance reduction." If a student can be led to recognize that two previously unrelated beliefs, both of which he holds, are in fact contradictory, he will be motivated to resolve this discrepancy and should be particularly receptive to instruction that helps him reduce this cognitive dissonance. Cognitive dissonance has been studied more by social than experimental psychologists, and little has been done to apply the results to education.

Some psychologists who study the physiological and biochemical bases of learning and memory have speculated that it may be possible to develop psychopharmacological ways of treating learning deficiencies. Since the creation of a "memory pill" could have tremendous educational implications, this work is obviously relevant to the NIE mission. At the present time human psychopharmacology is still in a basic research phase; a specific development effort based on current knowledge would be premature. The field is growing rapidly, however, and its potential implications should not be ignored.

In addition to devising and testing theories that deal with learning in general, some psychologists are currently undertaking the study and analysis of specific subjects taught in school: arithmetic, spelling, reading, etc. The theoretical issue involved concerns

"transfer"—the effect of previous learning on subsequent learning—which often can be studied most extensively with relatively large and organized bodies of knowledge. Such studies should be encouraged and should be related to work in curriculum development.

Even apart from its interest as a school subject, the subject of reading and learning through reading is of great interest because of its continuing importance throughout life. The study of reading is attracting the attention of psychologists from many fields and should continue to be a central concern of educational research and development. Furthermore, because of the primary importance of reading, it is especially important that current findings in this area be communicated to teachers without delay. For example, teachers should be alerted to recent work by Paul Rozin, Lila Cleitman, and Harris Savin demonstrating that an inability to segment spoken words into vowels and consonants makes it almost impossible for some children to read alphabetic writing. However, the problems of poor readers are often not task-specific but rather relate to more general psychological problems.

Developmental Psychology. What does "reading readiness" really mean? Should we postpone formal reading instruction until the age of seven, say, when presumably all students will have achieved reading readiness? Such questions are typical of a class of problems related to cognitive growth and development. Extensive research on developing children has indicated that psychological growth, like physical growth, unfolds in a relatively predictable order, although the time course is variable for different skills and different children. Of particular relevance to education is the sequential development of cognitive skills, although, as noted previously, noncognitive dimensions can have critical effects on cognitive performance. NIE should maintain an active interest in the educational implications of developmental studies.

Since development proceeds most rapidly and has been most extensively studied during the first years of life, a basic policy issue for N'E is the extent to which its resources should be committed to the study of the preschool years. In favor of such a commitment is the possibility of preventing developments that can handicap a child when he reaches school age and the possibility that some of the skills normally acquired in the early grades might be acquired—perhaps even better acquired—during preschool years. Since the age of entering formal education has been declining steadily throughout this century, it is likely that NIE may be forced into such a commitment in any case. On the other hand, some support for research in the first years of life is currently provided by such agencies as the National Institute of Child Health and Human Development, the National Institute of Mental Health, and the Office of Child Development; NIE might, therefore, achieve greater leverage initially by concentrating on studies of later development—adolescence and youth—which have been less well funded and are of more direct concern to formal education.

Technological progress has steadily increased the demands on our educational system at all levels to provide more skills and more knowledge to all citizens. It is inevitable, therefore, that thoughtful educators will look for ways to accelerate learning. And as the pragmatic arguments mount in favor of daycare for young children—arguments from working mothers as well as from the economically deprived—it is probably also inevitable that many people should want daycare centers to provide something more than baby-sitting services. Developmental psychologists have much to contribute to any program of education during these earliest years.

Theoretically, however, the field is in some turmoil. The basic aim of developmental psychology is to understand the process of normal development, not to accelerate it. Thus, the recent questions about acceleration and intervention have led to some basic disagreements. One school of thought holds that anything can be learned by any child at any age if it is presented to him in an appropriate manner; advocates of this view turn to developmental psychology to discover what the "appropriate manner" is at each stage of cognitive growth. Others argue that the important advances in psychological development are maturational and not trainable; they look to developmental psychology to discover when maturation makes training feasible. And still another view, deriving from studies of instinctive behavior in animals, assumes the existence of "critical periods;" they argue that appropriate education during a critical period of cognitive development is particularly effective because the child will be naturally interested in learning at that time and extrinsic sources of reinforcement will be unnecessary.

Intensive research has been devoted to such questions in recent years, but it is probably too soon to decide which of these views, if any, are nearest the truth. Although the initial studies seemed to indicate little effect of training in such cognitive skills as those described by Piaget, recent studies have been more successful. Further research is needed.

One aspect of early cognitive development that has been explored extensively during the past decade, and that seems of particular importance educationally, is the growth of the child's capacities for linguistic communication. Linguistic and conceptual development are complexly related, and what a child says is not always a reliable guide to what he understands. Still, so much of the educational process is mediated by language that a better appreciation of children's language would seem an important component in any rational approach to better education. Linguistic development is obviously important to anyone who teaches children to read and write, and it may have important implications for the education of children who speak nonstandard dialects of English. In this field, therefore, the NIE should probably attempt to establish itself as the primary source of support.

Whatever decision is made concerning NIE's interest in early development, studies of later stages of development are obviously of critical importance for education. Adolescence is particularly interesting, since this is a period of rapid physical, psychological, and social change and it occurs at a time when school attendance is mandatory. Education cannot solve the problems of adolescence—of sexual adjustment, of drugs and violence, of increasing suicide rates in minority males—but at least education should not contribute to those problems. A better understanding of adolescent psychology in our rapidly changing society seems imperative.

Two specific suggestions, made previously but endorsed by the conference, are (1) that courses should be introduced in high school that help the adolescent understand his psychological status and prepare him realistically for adulthood and parenthood in his community, and (2) cross-age interaction should give older students first hand experience in dealing with younger children.

Finally, it should be noted that, even though the processes of learning and the processes of development have been differentiated historically by psychologists and investigated by different groups of workers using rather different techniques, the distinction between learning and development should not be overdrawn. Development is much more than genetically-paced maturation; it incorporates cognitive, emotional, physical, and social learning, so the student of development is necessarily a student of the learning process as well. Moreover, the historical distinction has tended to foster arguments about the relative importance of nature vs. nurture in development, and may have encouraged psychologists to place too heavy an emphasis of such questions as when children are naturally ready for particular kinds of educational nurturance, with a consequent neglect of what is best for a child's well-being when viewed in a larger social context.

Counseling and Clinical Psychology. Although experimental psychology has seldom made important observations of human behavior in naturalistic settings, many clinical psychologists have taken such observations seriously. Educators should make use of this knowledge. In addition, clinical concepts, such as motivational development, which are important to education should be standardized so that tests can be developed to measure them. Clinical insights could probably be more helpful to teachers than anything else psychologists have to offer.

It is a common observation that children differ in temperament and that these differences are manifest from the moment of birth. In recent years, however, less attention has been devoted to temperamental differences than to differences to cognition and intelligence. Clinical psychologists interested in personality believe that these temperamental factors can cause different children to react differently to the same environmental influences, and that temperament-environment interactions can have critical effects on the formation of personality. Traditionally, our classrooms have been designed for children who are not hyperactive, irregular, distractable, or unfriendly, and who are persistent, adaptable, and positive in their response to new experiences, yet this particular constellation of temperamental traits is found in only a small fraction of the population. Psychologists who combine an interest in developmental and clinical psychology should be encouraged to explore the educational consequences of these temperamental differences and to seek methods of diagnosing and prescribing treatment for students temperamentally at odds with traditional methods of instruction.

Clinical psychologists can be of most help in understanding children with specific problems. For instance, clinical psychologists can help teachers understand the problem of children with learning disabilities and those with minimal brain damage. Research is also being conducted by clinical psychologists on children's self-concepts; this work is especially relevant to the problem of disadvantaged children. In addition to research, clinical psychologists themselves are needed in the schools for counseling both the teachers and the students. It is not obvious, however, where clinical psychologists would function in our present educational system.

Social Psychology. The last field of psychology of obvious relevance to education is the large and ill-defined field of social psychology. The conference did not include anyone strictly in the field of social psychology, so it is hoped that the potential contributions of this field can be outlined in detail by some subsequent planning group.

However, several areas where social psychologists can interact with educators are obvious. In particular, alternative proposals for community involvement in education should be prepared by social psychologists. There are many reasons for involving parents actively in the education of their children. Indeed, some have argued that families should be subsidized on the basis of their children's progress in school in order to provide a direct and immediate payoff for education.

Much research has been done during the past twenty years on optimal conditions of work for task-oriented groups. The results have been applied in business and industry, but little has been done relevant to education. The possibilities should certainly be explored.

The problem of innovation in education should also be considered by social psychologists. We must learn how to deal with hostile responses of parents to experiments involving their children. Ethnic support is especially needed for studies involving deprived youths. It must be stressed that even if research has provided support for a new program, innovation will not be successful without the development work necessary to prepare for its introduction into society. Until the steps needed to gain social acceptance for an innovation have been outlined, the program of research and development is not really complete.

RESEARCH EVALUATION AND ASSESSMENT

An essential part of any R&D operation is adequate program evaluation and assessment. Psychologists, especially psychometricians, have a wealth of knowledge to offer the NIE in this area. In the past, evaluation of new teaching procedures or curricula has generally involved the comparison of matched classes using the new and the old techniques. Educational researchers are quite sophisticated in the design and analysis of such experiments. Since such techniques are essential for serious research, this kind of work should be nurtured and extended.

There are other needs, however. Good experimental design does not insure that the innovation being tested is worthy of such an investment. Sometimes important side-effects of a new program are overlooked by single-minded attention to academic progress. And usually nothing is learned about the effects on individual students. In some cases educational programs have been evaluated in terms of their effect on IQ scores. More relevant measurements must be devised both in the cognitive realm, where Piaget's concepts should be incorporated, for example, and in the realm of personality, where effects on creativity, curiosity, and competence motivation might be included.

Education is not a product but a service; perhaps it should be evaluated in terms of satisfaction of its customers—the parents and students. The problems of such an evaluation are obvious. Different people expect different services. Some parents are interested in the quality of education; another group evaluates an educational program in terms of the daycare it provides—do the students eat well, are they kept clean, etc., and a third group is interested in the status that education provides. Moreover, the attitudes of parents may change through the years.

Essential to the development of any battery of evaluative tests is testing the reliability and validity of the individual tests and test questions. Statisticians and psychologists knowledgeable about testing should be exploited at this point. Psychometricians may not be the appropriate psychologists to call upon, since they are accustomed to norm-reference testing involving maximum individual differences, rather than to the criterion-reference testing essential for the evaluation of programs and the measurement of achievement across groups.

Science is built on a foundation of mutual mistrust; one should never accept the result of an experiment until it is replicated. Such a conservative outlook is especially important when dealing with educational R&D, where outcomes often have great social implications. Large and important innovations, such as Headstart and "Sesame Street," should be evaluated by several different groups. Even then, somebody has to make a decision about which evaluation is definitive and which is not. Otherwise an inadequate or inaccurate early evaluation of an important program could lead to its premature termination. The NIE should support attempts to evaluate various evaluation studies, such as that initiated by the Russell Sage Foundation.

When possible, experimental designs using the random assignment of classrooms, schools, or pupils to experimental and control treatments provide the best evaluation and are worth the extra planning and administrative effort they require. However, where conditions make such experimental control impossible, proper planning may make applicable one of a number of acceptable quasi-experimental designs. Under many conditions, these can provide useful approximations to experimental inference, albeit more equivocal and requiring more presumptions. Although widely employed, the use of matching and covariance adjustment as substitutes for randomization in achieving pretreatment equivalence is biased, producing regression artifacts, and these techniques are not among the acceptable quasi-experimental analyses. (D. T. Campbell and J. C. Stanley, *Experimental and Quasi-Experimental Designs for Research,* and D. T. Campbell, "Reforms as Experiments," *American Psychologist,* 1969, provide useful reviews of such methods.)

HUMAN RESOURCES AND TRAINING

After considering the educational problems that the NIE must face, the areas of psychology where research will be necessary to help solve those problems, and the important work to be done on experimental revision and evaluation, the question of manpower inevitably arises. Who will do this work for the NIE?

Training of Scientific Personnel. The manpower need for educational R&D today is comparable to that for clinical psychologists just after World War II. The need is not, however, merely for more psychologists or more teachers. It is rather a need for a new type of researcher who can split his time between task-oriented and discipline-oriented research. People interested in the application of theory as well as the theory itself are necessary. Just as economists move easily back and forth from the university to Washington, the educational researcher will have to move between the university, the schools, and NIE. The concept of "experimental schools" might be expanded to include schools with laboratories attached, just as modern hospitals have clinical and research laboratories integrated into their delivery of services to patients.

These proposals would call for a revision of the educational psychology programs that exist today. In order to attract high-quality manpower, educational psychology would need to become a reputable field in university psychology departments, as well as in schools of education. The new psychology of education would have to consider problems that are unique or endemic to education. It would have to cross narrow disciplinary lines and encompass all those fields of psychology—differential psychology, learning theory, developmental psychology, clinical psychology and social psychology—that are relevant to it. In addition, a new approach to the subject matter of these fields would have to be developed, one closer to engineering than to the theory and experiments of traditional psychology programs. The task of building this new psychology of education would be the responsibility of the NIE, since university psychology departments would most likely be reluctant to build such programs on their own. For that reason, support for training would be a necessary part of the NIE's budget. A funding mechanism modeled after the "research-training grants" of NIH should be considered (see below).

Another manpower problem is especially striking in light of the NIE's goal to achieve equality of education. Programs aimed at upgrading the quality of education for minority groups will not be successful without the cooperation of the ethnic groups themselves. However, many Blacks question the value and relevance of psychology as a career. Those who do find their way into psychology and education are often labeled "Uncle Toms." Widespread ethnic support of the programs of the NIE, therefore, should be cultivated.

Training of Teachers. The training of teachers may need to change along with the training of the

psychologists. If it is not possible to train the teachers to be researchers, as Piaget has done in Geneva, at least it should be possible to keep the teachers up to date with advances in educational research. The new educational psychology developed by the researchers should be shared with the teachers. Teachers should be aware of the interesting things their students are doing every day, things relevant to educational research and theory. If teachers become aware of even the more general psychological findings, such as the importance of positive reinforcement and the existence of cognitive developmental stages, their teaching should reflect their knowledge. Clinical psychology is especially important to teachers for dealing with "problem students." In addition, teachers may have to learn to cope with the demand of different teaching "levels." Teachers must teach each individual as well as the class as a whole; they should understand and be tolerant of individual differences and at the same time be aware of the structure and dynamics of the class as a whole. A basic knowledge of differential psychology and social psychology should be provided in an appropriate and relevant form. It may be necessary to develop a new breed of educational technologists whose role would be to make such knowledge more readily available to the teachers who need it. Moreover, technical knowledge as well as knowledge of psychology is important for teachers. The dissemination of innovative teaching techniques should be made more widespread. Many new and interesting teaching ideas are lost because the innovator fails to get them into the literature; NIE should certainly try to remedy this situation.

Training of Applied and Development Personnel. The training of R&D personnel in this area of educational technology is yet another problem to be considered. The constant growth of technology means that those personnel being trained today cannot merely be taught the techniques and methods of the present. They must be trained rather for the technology of the future, where computers and other new media will be the rule rather than the exception and younger children will probably be attending school. Closed-circuit television should be exploited to its capacity, for it is a useful tool not only in the classroom but for teacher training as well. Computer-Assisted Instruction (CAI) is another area where considerable training is important. CAI can solve the problems of individual differences and individualized instruction without getting into the problem of fostering negative self-concepts in the slow learners, since CAI artfully masks training levels and can be free of racial prejudice. To permit major advances in CAI, however, researchers in this area will need a broad base of training including instruction in artificial intelligence and cognitive psychology, as well as in computer technology

R&D personnel will also face problems of curriculum design and redesign. Curricula today should include the training of thinking and socialization as well as the training of arithmetic and reading. Recent work by Seymour Pappert and his colleagues in teaching young children how to write computer programs is one interesting advance in the training of thinking. Revisions are important in the training of conventional subjects as well. For example, researchers need to develop a series of readers that are not only ethnically but geographically oriented as well; the Black child on the West Coast faces many different problems from the Black child in Harlem. This area of R&D is certainly one where minority group members are needed.

Training of School Psychologists. School psychologists have traditionally been trained as psychometricians to handle the psychological testing of students in the school. The possibility of redefining the responsibilities of school psychologists and upgrading their skills and responsibilities should be considered. Many school psychologists today are taking on the job of student counseling. This aspect of their work should be expanded, which would necessitate substantial training and instruction in the area of clinical psychology.

Ideally, every school should have access to complete research facilities, including programs of curriculum development and teacher training as well as testing and counseling. NIE should support proposals to develop such services and to expand greatly our conception of what a school psychologist can be and do.

TOWARDS INTERDISCIPLINARY MEETINGS

The discussion reported in this paper was by a group of psychologists who came together to consider what was the potential contribution of psychology to educational R&D. However, one point that was made clear throughout the discussion was that effective educational research will have to be interdisciplinary in nature. A series of meetings devoted to interdisciplinary aspects should be held. Some suggestions for these meetings are summarized here.

One important consideration of an interdisciplinary group is the training of researchers. As was remarked earlier, those doing educational R&D will need a broad base of training in the several fields of psychology discussed as well as in such fields as sociology, anthropology, linguistics and computer science.

Another interdisciplinary meeting, or series of meetings, should be content-oriented. For example, one group might consider the teaching of arithmetic, another history, etc., and certainly one group should consider the teaching of reading. Every individual has a need and a right to learn how to read, not just in the narrow sense of translating written to spoken prose, but in the broader sense which includes, for instance, giving and following directions effectively. Using this broad definition, many high school graduates do not know how to read. Solving this problem should be an important goal of the NIE which will encompass the work of researchers from a multitude of disciplines.

Another interdisciplinary meeting might concern itself with the problems of continuing education. With the advance of technology, the retraining of adults is a more important problem than ever before. Discussion should involve, for instance, how to make use of the public schools in off hours as centers for adult education. However, the schools are not the only place where learning can occur. In fact, education outside the school is as important for the child as the adult. For this reason, the NIE should make contact with groups providing education outside the school. People in the fields of children's television and children's games, for instance, might work with NIE so that they too can teach more effectively and be more responsible to the psychological needs of children.

Another interdisciplinary meeting might be concerned with the various disciplinary research methods and their coordination into a program of educational research. For example, the group might discuss how the methods of the cultural anthropologist can be applied to the study of education or what recent advances in statistics imply for educational research, or how clinical concepts from psychology can be captured in measurements, or how sociologists would describe and evaluate the social structure of a school or school system, and how economic models can be integrated into educational research, etc.

Finally, some planning should probably be directed toward the organization of the basic research of interest to NIE, in addition to the applied R&D interests that defined the topic of this report.

NIE SUPPORT FOR THE TRAINING OF BEHAVIORAL SCIENTISTS

At present, no provisions have been made in the planning of NIE for federal support of students who might wish to enter the field of educational research. Participants in the conference felt that this omission greatly weakened the impact NIE might have and reduced the likelihood that the best people could be attracted to the field. Some of the arguments, both pro and con, are summarized here.

Presumably, the economic rationale for NIE is that the basic knowledge needed for educational progress is a public good and that private enterprise would underinvest in such research because its results could not be sequestered and appropriated by individuals. Even if the results could be patented or copyrighted in some way, they should not be, since the cost of spreading knowledge is negligible; the use of knowledge by one individual does not mean that less is available for others. Thus, the government necessarily is interested in scientific research in education.

If one accepts the long-term commitment of government to the support of research and the need for trained personnel to conduct that research, then one faces next the question of whether government is also committed to support training. Since 1969 the support of training has been systematically reduced; the reasons stated publicly are that government should support research per se and rely on the operation of the market to draw people into the socially needed fields of science and to induce them to secure the necessary training at their own expense. Economically, the investment in graduate training in science has been profitable for those individuals who can afford it, and, so the argument goes, should not be further subsidized at public expense.

This argument has some merit in established areas of science and technology, where requirements are changing slowly and potential students can evaluate future markets for their training. In the present case,

however, the government's interests are best served by deflecting talented students into new career lines, where training programs in the universities are still not established and where potential students cannot realistically estimate the market value of their training. The well known imperfections of the market, together with a lead time of seven to ten years required to produce scientific personnel, would result in intolerable delays. Individuals would underinvest in education of the type needed by NIE, and universities would not create the needed training programs in the absence of a visible student demand for such training.

Therefore, in order to induce universities to initiate necessary programs and to reduce the risk to individuals who would enroll in them, the federal government must subsidize the universities willing to make such innovations and those talented students willing to risk their professional lives on the possibility of eventual careers in this new national effort. The "research-training grants" that evolved at NIH to stimulate biochemical science would seem to provide an ideal model for meeting the manpower needs of NIE. An even more positive solution would be to create and support problem-oriented research training institutes in several universities, along the lines recommended in the BASS Report (*The Behavioral Sciences: Outlooks and Needs.* Washington, D.C.,: National Academy of Sciences, 1969).

A substantial part of the return on the investment that an individual would make in his own training for educational R&D would consist in external social values for which the individual would receive no proportional compensation. An individual embarking on such a program of training faces a relatively high risk of failure, depending on his pattern of abilities; deficiencies in talent cannot be compensated for by increased investment, and the individual may have very imperfect information about his likelihood of success. In the past, it has been generally recognized that the risks involved should be shared between the individual and the government, and that the government should invest substantially in the discovery as well as the development of talent. By offering training subsidies to talented individuals, government makes it possible for young people from all strata of society to seek scientific careers. Since ethnic issues are critical for many educational reforms that we may wish to undertake, this means of insuring broad participation from all social classes and racial groups is especially important for NIE in particular and for the educational system in general.

Those who argue in favor of support for research, with training left to individual investment, have pointed out that many of the senior workers whose research will be supported will be university professors and that talented students can be supported as research assistants. The difficulty with this mechanism of support, however, is that the student is necessarily the captive of his professor; he must work on the problems that the more senior scientist has obtained funding to investigate. He is not free to explore his special interests. In particular, he is not free to prepare for research of future value to society, since he is indentured to a professor concerned with current problems. The amount of investment required for research-training grants would be relatively small by comparison either with the value of the trained individual to society or with the magnitude of the total budget of NIE (not to mention our total national investment in education).

In view of these considerations, the participants in the conference were persuaded that it is essential to the success of NIE to provide some form of direct support for universities and individuals willing to undertake the indicated programs of research training.

AFTERTHOUGHTS

Following the conference, a preliminary draft of this report was circulated to the participants and various editorial changes were incorporated as a consequence of that correspondence. Several of the comments were of a more general nature, however, and could not be easily incorporated into the existing draft. This section, therefore, is intended to summarize several of these afterthoughts in as integrated a manner as possible.

A basic assumption in the discussion of the planning conference seems to have been that education is academic in nature. Although all the participants were aware of vocational training, of extra-curricular programs, and of other forms of educational opportunity that our schools provide, and although passing mention was frequently made of the importance of temperament and personality as well as intelligence and of the relation of the school to the community it serves, the pressure of time and relatively greater

familiarity with the academic dimensions of education seem to have biased the discussion and the report based on it. However, NIE will necessarily be concerned with this broader range of problems, and psychologists should have as much to contribute there as they have to academic issues.

Once the definition of educational goals is broadened beyond the academic, it is difficult to know where to stop. Indeed, even if one insists that academic achievement should have first priority, the scope of NIE's task cannot be limited to teacher-pupil interactions in a traditional classroom. Consider the fact that the amount a pupil learns is closely correlated with the amount of time he studies; the amount of time he studies is, in turn, more directly correlated with his level of academic motivation than with any other personal characteristic; and his level of academic motivation is critically influenced by the total environment in which he lives and develops. Thus, even if one cares only about academic achievement, one cannot "solve" the problem by simply providing more teachers, modern curricula, new teaching methods and materials, more systematic use of extrinsic sources of motivation, better classrooms, etc., for none of these makes any significant impact on a social situation that includes the educational institution as merely one of its many components.

Perhaps a broader definition of educational goals would enable schools to provide better and more obviously relevant services to their students and to the whole community. The magnitude of the problem that the schools face, however, must not be underestimated. It was well expressed by one of the participants, who wrote: "Yesterday I spent the morning in Harlem at a preschool where I have been working for a while. I was chatting with the teacher about parent interest. 'Do you make home visits?' I asked. 'No,' she said. 'It's partly that I don't have time, but mostly that I'm afraid. I never know who I'm going to meet in the elevator.' Parents are afraid too, and the small children sit home when not at school. Tell me, what can I do with those children in three hours that will change the course of their lives?"

The problem of equality, quality, and efficiency in education cannot be "solved" by basic research, applied research, and interdisciplinary teams that convert research into practice. As the Levien report indicates, there are many researchable aspects to these problems, and as the present report argues, psychologists can provide valuable input to many of the sub-problems. But it seems unlikely that our educational institutions can play their appropriate and expected role until some of the more general problems of contemporary American society are resolved. The situation will not improve until social-structural changes occur to remove the constraints keeping the situation the way it is. Such changes in society cannot be made by our existing educational system, however NIE may buttress it through research and development with better methods of doing what it is presently trying to do.

One is led, therefore, to think of experimentation on a rather larger scale than might be contained in a laboratory, a classroom, a school, or even a school system. The appropriate arena would seem to be a whole community. Suppose a group of social scientists was assembled with a mandate to design a ghetto neighborhood in such a way as to make it possible to study the social and psychological variables that they have some reason to believe control the relevant phenomena—in this case, phenomena related to equality, quality, and efficiency in education. Such an interdisciplinary team would face an enormous challenge to its creative resourcefulness and to its ability to conceptualize, reconceptualize, and implement its program. At present, there is a tendency for workers in each discipline to appeal to variables that line in the province of some other discipline; the interdisciplinary team we are imagining would have no such convenient place to hide. Faced with the prospect of running a model neighborhood, they would be responsible for *all* the variables involved, regardless of their disciplinary affinities. And they would be responsible for manipulating variables assumed to be important: getting jobs for fathers, providing adequate housing, caring for pregnant mothers, giving post-natal care and tutoring of mothers, mediating relations with police, welfare, medical, and other agencies of government, etc., as well as designing an optimal educational system for the neighborhood.

There are many practical and political reasons why this experiment would not be feasible (even if it is scientifically defensible), but even the conceptualization of such an experiment should provide valuable perspectives both for social leaders and for those working on various components of the larger problem. But if the experiment could be conducted, and if, as some social scientists believe, the social variables turned out to be more important educationally than the

educational variables, the mission of NIE would have to be redefined quite radically.

This suggestion is, of course, quite tentative, but it may serve to give some more tangible form to the feeling that, if NIE is to accomplish the purpose set for it in plans formulated to date, something more serious and decisive and on a larger scale will be required than we have seen in the past.